SECTION 02772

GEOSYNTHETIC CLAY LINER AND CAP

PART 1 GENERAL

1.01 SCOPE

A. This Section includes geosynthetic clay liner and cap products furnished by Fluor Daniel Fernald (FDF) and installed by the Contractor for the cell liner system and cell final cover system, respectively.

1.02 RELATED SECTIONS AND PLANS

A. Section 02215 - Trenching and Backfilling

B. Section 02225 - Compacted Clay Liner and Cap

C. Section 02710 - Granular Drainage Material

D. Section 02714 - Geotextiles

E. Section 02770 - Geomembrane Liner and Cap

F. Part 8 - Environmental Health and Safety, and Training Requirements

G. Part 9 - Quality Assurance Requirements

1.03 REFERENCES

A. Latest Version American Society of Testing and Materials (ASTM) Standards:
   1. ASTM D 638. Standard Test Method for Tensile Properties of Plastics.
   2. ASTM D 792. Standard Test Methods for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
   3. ASTM D 1004. Standard Test Method of Initial Tear Resistance of Plastic Film and Sheeting.
   4. ASTM D 1238. Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.

5. ASTM D 1505. Standard Test Method for Density of Plastics by the Density Gradient Technique.
6. ASTM D 1603. Standard Test Method for Carbon Black in Olefin Plastics.
7. ASTM D 4632. Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
8. ASTM D 4643. Determination of Water (Moisture) Content of Soil by Microwave Oven Method
9. ASTM D 4833. Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
10. ASTM D 5596. Standard Test Method for Microscopical Examination of Pigment Dispersion in Plastic Compounds.
11. ASTM D 5887 Standard Test Method for Measurement of Index Flux through Saturated Geosynthetic Clay Liner Specimens Using a Flexible Wall Permeameter.
12. ASTM D 5890. Standard Test Method for Swell Index of Clay Mineral Component of Geosynthetic Clay Liners.

B. Latest version of Geosynthetic Research Institute (GRI):
   1. GM8 Standard Test Method for Measurement of the Core Thickness of Textured Geomembrane.

1.04 HEALTH AND SAFETY REQUIREMENTS

A. Environmental, health and safety, and other training requirements shall be as specified in Part 8 of the Contract Documents.

PART 2 PRODUCTS

2.01 GEOSYNTHETIC CLAY LINER AND CAP

A. FDF will furnish geosynthetic clay liner and cap products that meet the following requirements:
   1. Geosynthetic clay liner and cap will consist of a bentonite core with textured 40-mil HDPE geomembrane backing, or internally-reinforced bentonite core with nonwoven geotextile and woven geotextile backings, as indicated on the Construction Drawings.
   2. Geosynthetic clay liner and cap will have properties that comply with the required values shown in Table 02772-1.

3. Physical attributes of the geosynthetic clay liner and cap are available from the Construction Manager upon request.

2.02 PACKAGING

A. Geosynthetic clay liner and cap rolls will be wrapped in impermeable and opaque protective covers.

B. Each geosynthetic clay liner and cap roll will be marked or tagged with the following information:
   1. manufacturer's name;
   2. product identification;
   3. lot number;
   4. roll number;
   5. roll weight; and
   6. roll dimensions.

C. Geosynthetic clay liner and cap rolls not labeled in accordance with this Section or on which labels are illegible will be rejected and replaced. Contractor shall notify the Construction Manager of any missing or illegible labels.

2.03 STORAGE AND PROTECTION

A. Within 45 days of Authorization to Mobilize, Contractor shall inspect and inventory the geosynthetic clay liner and cap material and the manner in which it is stored. Contractor shall provide a written letter of acceptance within 45 days to the Construction Manager if material is acceptable for installation. Contractor shall also notify the Construction Manager in writing within 45 days of any geosynthetic clay liner and cap material not acceptable for installation.

B. Maintain a program for protection and preservation of geosynthetic clay liner and cap to include, but not be limited to:
   1. handling, storage, and care for the geosynthetic clay liner and cap in a manner that does not cause hydration or damage;
   2 protection of the geosynthetic clay liner and cap from moisture, excessive heat or cold, puncture, or other damaging or deleterious conditions; and
   3. storage of the geosynthetic clay liner and cap rolls on palates or other elevated structures.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Provide certification in writing that the surface on which the geosynthetic clay liner and cap will be installed is acceptable as described in this Section. Give this certification of acceptance to the Construction Manager prior to commencement of geosynthetic clay liner and cap installation in the area under consideration.

B. Maintain the prepared soil surface in accordance with Section 02225.

C. Do not place the geosynthetic clay liner and cap onto an area that has been softened by precipitation or that has cracked due to desiccation. Repair such areas in accordance with Section 02225.

3.02 CREST ANCHOR SYSTEM

A. Excavate the anchor trench in accordance with Section 02215 prior to geosynthetic clay liner and cap placement. Excavate to the lines and grades shown on the Construction Drawings.

B. The anchor trench beneath the geosynthetic clay liner and cap shall be firm, clean, and dry.

C. Temporarily anchor the geosynthetic clay liner and cap in the anchor trench until all geosynthetic layers are installed in the anchor trench. Do not place geosynthetic clay liner or cap in anchor trench if standing water is present.

D. Install other geosynthetics in the anchor trench in accordance with Sections 02714 and 02770. Backfill the anchor trench in accordance with Section 02215. Place granular drainage materials over the geosynthetics in accordance with Section 02710.

3.03 PLACEMENT

A. Do not commence geosynthetic clay liner and cap placement until the CQC Consultant completes performance evaluation of previous work, including Contractor's survey results for previous work.

B. Weight geosynthetic clay liner and cap with sandbags or other means to prevent uplift or movement in wind. Immediately remove and replace any damaged or leaking sandbags.

C. Cut the geosynthetic clay liner and cap using a utility blade. Do not damage underlying material during cutting and fully repair any such damage.

D. Do not entrap stones or other foreign objects under the geosynthetic clay liner and cap. Do not drag equipment across the exposed geosynthetic clay liner and cap.

E. Replace any geosynthetic clay liner and cap that is damaged by any means including foreign objects, or installation activities.

F. Install geosynthetic clay liner and cap that has a sodium montmorillonite core and a textured 40-mil HDPE geomembrane backing with the HDPE geomembrane backing down. Install geosynthetic clay liner and cap that is internally-reinforced with the nonwoven geotextile backing down.

G. Do not install the geosynthetic clay liner and cap on a wet subgrade or in standing water. Prevent hydration of the bentonite core prior to completion of construction of the liner system or final cover system, as appropriate.

H. Do not install the geosynthetic clay liner and cap during precipitation or other conditions that may cause hydration of the geosynthetic clay liner and cap.

I. Install the overlying geomembrane as soon as possible following geosynthetic clay liner and cap installation. Cover all geosynthetic clay liner and cap that is placed during a work day with overlying geomembrane. Cover and protect the edges of geosynthetic clay liner and cap from hydration due to stormwater runon.

J. Remove and replace geosynthetic clay liner and cap that becomes hydrated. Hydration is defined by a moisture content of 40 percent or greater when measured in accordance with ASTM D 4643.

K. Place earthen material for the liner and final cover systems on top of the geomembrane and other geosynthetics overlying the geosynthetic clay liner or cap as soon as possible after installation of the geosynthetic clay liner or cap.

3.04 OVERLAPS

A. On slopes steeper than 5 horizontal to 1 vertical, install geosynthetic clay liners continuously down the slope; that is, allow no horizontal seams on the slope.

B. Allow no horizontal seams on the base of the landfill within 5 feet of the toe of a slope.

C. Overlap geosynthetic clay liner and cap in strict accordance with the Manufacturer's recommended methods. As a minimum, overlap adjacent panels at least 6 inches along the sides and 12 inches along the ends.

3.05 MATERIALS IN CONTACT WITH THE GEOSYNTHETIC CLAY LINER AND CAP

A. Perform installation of other components in a manner that prevents damage to the geosynthetic clay liner and cap.

B. Do not drive equipment directly on the geosynthetic clay liner and cap.

C. Install the geosynthetic clay liner and cap in appurtenant areas, and connect the geosynthetic clay liner and cap to appurtenances according to the Construction Drawings. Do not damage the geosynthetic clay liner and cap while working around the appurtenances.

3.06 REPAIR

A. Repair any holes or tears in the geosynthetic clay liner and cap by placing a geosynthetic clay liner and cap patch over the hole. On slopes greater than 5 percent, the patch shall overlap the edges of the hole or tear by a minimum of 2 feet in all directions. On slopes 5 percent or flatter, the patch shall overlap the edges of the hole or tear by a minimum of 1 foot in all directions. Secure the patch with a water-based adhesive approved by the GCL manufacturer.

B. Remove any soil or other material that may have penetrated the torn geosynthetic clay liner and cap.

C. Do not nail or staple the patch.

3.07 CONSTRUCTION QUALITY REQUIREMENTS

A. The CQC Consultant will monitor geosynthetic clay liner and cap installation as required by the Construction Quality Assurance (CQA) Plan, referenced in Part 9 of the Contract Documents.

TABLE 02772-1

REQUIRED GEOSYNTHETIC CLAY LINER AND CAP PROPERTY VALUES

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
GCL Properties				
Bentonite Content[2] (GCL)	minimum	lb/ft^2	1.0	ASTM D 5261
Bentonite Moisture Content	maximum	%	25	ASTM D 4643
Bentonite Free Swell	minimum	ml/2g	24	ASTM D 5890
Hydraulic Conductivity (Bentonite only)[3]	minimum	cm/s	5×10^{-9}	ASTM D 5887
Shear Strength (GCL)		See Note 7.		
Peel Strength (GCL)	minimum	lbs/in	15	ASTM D 4632
Textured HDPE Geomembrane Properties[4]				
Thickness	average	mils	40	GRI GM 8
	minimum	mils	36	GRI GM 8
Specific Gravity	minimum	N/A	0.94	ASTM D 792 or ASTM 1505
Melt Flow Index	maximum	g/10 min	1.0	ASTM D 1238 (Condition E)
Elongation at Yield	minimum	%	12	ASTM D 638
Elongation at Break	minimum	%	100	ASTM D 638
Strength at Yield	minimum	lb/in	95	ASTM D 638
Strength at Break	minimum	lb/in	50	ASTM D 638
Tear Resistance	minimum	lb	12	ASTM D 1004 Die C puncture
Puncture Resistance	minimum	lb	25	ASTM D 4833

TABLE 02772-1 (continued)

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
Carbon Black Content	range	%	2-3	ASTM D 1603
Carbon Black Dispersion	N/A	none	Category 1 or 2	ASTM D 5596

TABLE 02772-1 (continued)

PROPERTIES	QUALIFIERS	UNITS[6]	SPECIFIED[1] VALUES	TEST METHOD
Geotextile Properties[4]				
Polymer Composition	minimum	%	95 polyester or polypropylene	

Notes: 1. All values represent minimum average roll values (i.e., any roll in a lot should meet or exceed the values in this table).
2. Measured at a moisture content not exceeding 25 percent.
3. For GCL with geomembrane backing, perforate or cut backing to allow unimpeded and uniform flow through the backing. Test at an effective confining stress of 5 psi.
4. Geosynthetic clay liners and caps not having these components and otherwise satisfying Part 2.01 of this Section, are exempt from meeting the specified values.
5. Not used.
6. lb/ft^2 = pounds per square foot
cm/s = centimeter per second
min = minutes
g = grams
% = percent
lb = pound
lb/in = pounds per inch
ml/2g = milliliters per two grams
7. Shear strength of geosynthetic clay liner is in accordance with FDF RCI 1702-006R. Shear strength of geosynthetic clay cap is the same, except shear strength requirement for 45 psi normal stress is waved.

[END OF SECTION]